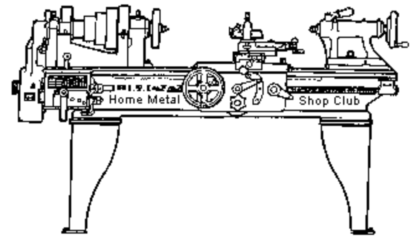
Home Metal Shop Club

February 2013

Newsletter

Volume 18 – Number 2



http://www.homemetalshopclub.org/

The Home Metal Shop Club has brought together metal workers from all over the Southeast Texas area since its founding by John Korman in 1996.

Our members' interests include Model Engineering, Casting, Blacksmithing, Gunsmithing, Sheet Metal Fabrication, Robotics, CNC, Welding, Metal Art, and others. Members enjoy getting together and talking about their craft and shops. Shops range from full machine shops to those limited to a bench vise and hacksaw.

If you like to make things, run metal working machines, or just talk about tools, this is your place. Meetings generally consist of general announcements, an extended presentation with Q&A, a safety moment, show and tell where attendees share their work and experiences, and problems and solutions where attendees can get answers to their questions or describe how they approached a problem. The meeting ends with free discussion and a novice group activity, where metal working techniques are demonstrated on a small lathe, grinders, and other metal shop equipment.

President Vance Burns	Vice President John Hoff	Secretary Martin Kennedy	Treasurer Emmett Carstens	Librarian Dan Harper
Webmaster/Editor Dick Kostelnicek	Photographer Jan Rowland	CNC SIG Dennis Cranston	Casting SIG Tom Moore	Novice SIG Rich Pichler

This newsletter is available as an electronic subscription from the front page of our website. We currently have over 360 subscribers located all over the world.

About the Upcoming March 9 Meeting

General meetings are usually held on the second Saturday of each month at 12:00 noon. Visit our Events Page for up-to-the-minute details, date, location and for the main presentation topic.

NOTE: The March meeting to be held at TxRx Labs. This is currently a one-time meeting location to allow our membership to mix and mingle in the TXRX environment and help them come to a consensus on their preferences concerning a meeting location. TxRx Labs is located at 205 Roberts Street, Houston Tx.

Norm Burls will speak about tramming a RongFu milldrill.

General Announcements

Videos of recent meetings can be viewed on the HMSC website.

The HMSC has a large library of metal shop related books and videos available for members to check out at each meeting. The library is maintained and curated by the club librarian, Dan Harper. These books can be quite expensive, and are not usually available at local public libraries. Access to the library is one of the many benefits of club membership.

We need more articles for the monthly newsletter! If you would like to write an article, or would like to discuss writing an article, please contact the Webmaster, Dick Kostelnicek. In the September HMSC board meeting, the board elected to waive membership fees during the next membership renewal cycle for those providing newsletter articles.

Ideas for programs at our monthly meeting are always welcome. If you have an idea for a meeting topic, or if you know someone that could make a presentation, contact the Vice President John Hoff.

Recap of the February 16 General Meeting

By Martin Kennedy, with photos by Jan Rowland

Thirty one members and four guests from the University of Houston Mechanical Engineering department – Johnathan Guerro, Ryan Williams, Marlon Arboleda and Nick Baiamonte, attended the 12:00 noon meeting at the Parker Williams County Library. President Vance Burns led the meeting.

The membership discussed meeting locations. Suggested locations were the TxRx Labs facility and several libraries - Eldridge, Stella Link and Montrose. Martin Kennedy made a brief presentation describing the TxRx Labs facility based on a visit by the Officers, and John Hoff described the libraries that he had visited. The membership voted on having the next meeting at TxRx. The results were15 votes for TxRx and 4 against.

Three topics were requested for future meetings: threading, making gears and cutting tool geometry.

Safety Moment

Vance Burns recounted an incident at a lab he visited. Two workers were installing PVC pipe using a cordless guillotine type cutter. On a dare, one guy stuck his finger in the cutter and the other worker pulled the trigger. The guy watched as the cutter slowly cut off the end of his finger.

Another hint was to listen for pitch changes when using machinery. A change in pitch can indicate the onset of a problem.

Rich Pichler said that a good way to not leave the drill chuck in a drill press was to use a spring loaded safety chuck. He also mentioned that it was good to have a face shield close to the tools requiring it so that it was readily available.

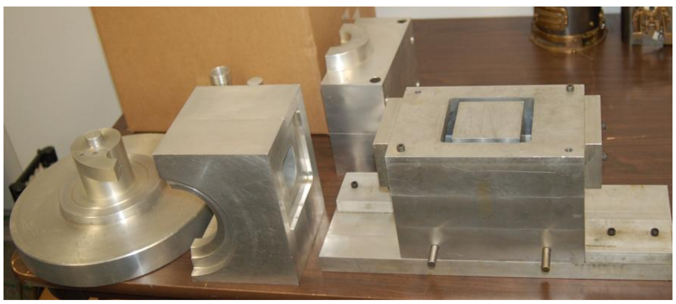
Norm Burls explained that when using cut off saws, it is necessary to wear both eye AND hearing protection. The saws make loud noises that can damage your hearing.

Kevin Capps reminded us to NOT wear gloves when using drills. He saw someone lose three fingers with a hob saw because his gloves became entangled in the tool bit.

Presentation

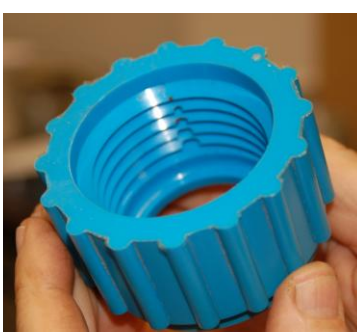
Kevin Capps is the owner of J3 Precision Urethane, located in Willis, TX. Kevin's company manufactures urethane products from molds that he machines in-house. Ninety-five percent of his customers are in the oilfield.

Making the molds requires a different thought process than machining a part. The mold is the inverse of the desired part. Kevin begins with blueprints of the parts. He works with the designer by provides input on features that can make it easier to make the part in urethane.



Kevin usually does not have mold drawings for the part. This is a specialized field, and only a few people in Houston can make mold drawings. To make the mold, he reverse engineers the drawing. The biggest challenge making molds is figuring out how to split and make removable components so that mold can be removed after casting. Also, there is an approximately 2% shrinkage that must be accounted for in the mold design.

The molds are usually made of aluminum, but can also be made of urethane. Urethane molds are cheaper, but don't last as long. Kevin does most of the machining himself, although he sometimes contracts out work for wire EDM. A typical mold takes more than 6 hours to make.



The molds are open cast molds, not injection molds. For casting, polyurethane is mixed from two parts - a polymer and a catalyst, which are mixed just before casting at a temperature of about 220°. The mold is also at the same temperature. A silicon based mold release compound is applied as an aerosol. The urethane is then poured into the mold. Various techniques are used to prevent bubbles from being entrained in the liquid, including mold design, mold preparation, careful mixing of the urethane, and sometimes even vacuum pouring. It takes about 15 minutes before the part can be removed from the mold. The completed product is allowed to cure for 16 hours at 220°.

Kevin showed several examples of molds, including a complicated hydrocyclone mold.

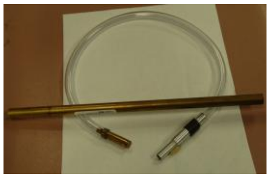
Show and Tell

Dick Kostelnicek brought in a disk that he thought might be a rotary file. One of the members identified it as a wheel used for milling flour.

Joe Williams showed some more types of micrometers to augument the ones shown last month by Dick Kostelnicek. He had an inspection micrometer that fit through a hole to measure wall thickness, a thread micrometer made for a limited range of Sellers threads, a small ½-inch micrometer that he said was very useful and a set of inside bore micrometers.

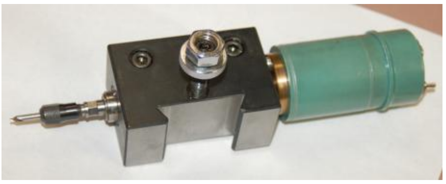
Tom Moore found some unusual tools in the back of his bottom drawer. The first was identified as a front and back chamfering tool missing cutters. He also had some tapered taps of different threads.

Martin Kennedy brought in a knurling tool that he made. He was impressed with one of the knurling tools he saw when making videos of several tools in action. This tool was easy to set up and consistently made good knurls. Martin's version incorporated floating heads to make it even easier to set up. The tool was challenging to make, as it employed several precision dovetails and left and right hand screw threads. Click here for the knurler plans.



Mike Winkler demonstrated a speed loader for a 22 rifle with brass screws representing the bullets and a tube representing the gun.

Ray Etheridge, the executor for Ed Gladkowski's estate, updated us on the disposition of the estate. He brought in the Colt Baxter steam engine that Ed had nearly completed, as well as a huge binder of notes and pictures that were used for the design. Ray said that Ed worked without drawings, as he had not found any in the documentation.



Phil Lipoma made a presentation based on his newsletter article last month by showing several tools and techniques he used for stamping and engraving. As well as using a rotary table, he modified several lathes to allow them to be able to index.

Tom Darragh made a vice to hold a gun barrel for removal of the receiver.

Problems and Solutions / Ask the Blacksmith

Four UH Mechanical Engineering students made a presentation showing their Capstone Project to design and build an automated Rope Climbing Device. The device has application in sports, military and search and rescue. The basic design is a winch motor with an attached battery that drives a special pulley that engages the rope.

They had specific questions around how to build the special pulley that grasps the rope. Members made

Karl Schuler showed pictures of a 1:12 scale model of the 1855 Novelty Works Gothic steam engine that he built from castings. He wanted to machine the 17" flywheel so that it looked like it was made of segmented castings. Several suggestions were offered.

A member said that he was thinking about buying a knee mill. He was concerned about the height, since his garage has a steel lintel. It was suggested that he consider a mill with a rotating head, as it can be put horizontal while moving. Another member mentioned that U-haul has a super low trailer designed for motorcycles, rated at 1600 lb, and 10-inches off the ground that might prove helpful. It was also suggested that he might want to consider removing a section of the garage wall temporarily.

A member was looking at indexing tables and asked about considerations for buying one. He wanted to know more about normal uses and how that should affect selection. It was recommended to use a 60:1 head. A discussion ensued about how you can get literally billions of combinations with compound indexing if you have multiple plates. It was mentioned that a cheap spin indexer might be all he needed.

Rich Pichler showed his drill/mill optical centering device. He said that through it, a scribed line looked like the Grand Canyon. The finest line he could make was using a #4 sewing needle and that was 0.002". He asked why you might want to measure to ten thousandths (0.0001") accuracy. After some discussion, the conclusion was that ten thousandths accuracy was generally not needed in hobbyist use.

Novice SIG Activities

Rich Pichler and the novice group demonstrated drilling techniques.

Making a Small Pinion Gear

By *J. R. Williams*

A friend brought a small Hardinge H-4 Index unit to my shop (left photo). It was missing a key component: a small pinion shaft with a handle used to retract an internal index pin. Careful measurement and checking gear calculations showed it to be 6-tooth, 18-pitch. The OD of the gear fits snugly into a hole in the unit's casting.

Gear cutters come in sets of 8 cutters for producing gears from 12 teeth to rack (a straight or inline gear). A number 8 cutter generates 12 and 13 teeth and the number one cuts 135 teeth up to rack. No cutters are listed for a 6 tooth gear.

Time to resort to the old fall-back position: hand grind a single tooth fly cutter without the benefit of a pattern. I calculated the tooth depth and width and ground a high speed steel tool bit to fit the gear tooth proportions. A quick trial run, using a section of aluminum rod, produced a rough gear; close but no exactly correct (right photo). With a little more grinding on the cutter and by using a steel blank, I produced a gear that after a little dressing worked just fine. All that remained was to machine a slot for a guide screw with a cross-hole and set screw for the handle.

This project was a good exercise in making an odd shaped small part. I've made a small brass gear for a washing machine timer drive, a gear for a trailer jack, a splined drive shaft section for a GT-6 automobile and a few timing belt pulleys and gears, but this one was the most difficult. It 's a simple project to cut gears with a standard gear cutter but a bit more challenging doing it with a single point fly cutter.

The above photo shows the repaired Hardinge H-4 Index unit with the index plunger engaged into the rear index plate. The plate has blind holes that are not visible from the outside.

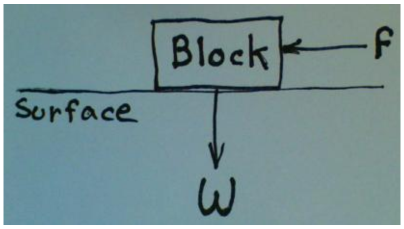
Epilog - A replacement part was found late in the project (left photo). The OD of the gear teeth section is 0.440 inch and the head is ¾-inch.

Self Holding Tapers

By *Dick Kostelnicek*

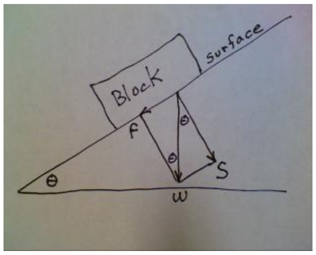
As mechanics, we encounter machine spindles that hold tooling and cutters via a tapered fit. Many such tapers are so called “self-holding”. In other words, they firmly hold a tapered arbor without slip in a socket of similar shape. The Morse, Brown & Sharpe, Jacobs and Jarno tapers are self-holding. The 5C, R8 and NMTB or NT are examples of self-releasing, sometimes called “fast” tapers. Fast tapers require a key and drawbar or threaded ring to keep them secured.

Just by pressing a self-holding tapered arbor into a like tapered spindle gets it held in place. The harder you push on it, the tighter it becomes stuck. How does that happen? Well, it’s by friction and

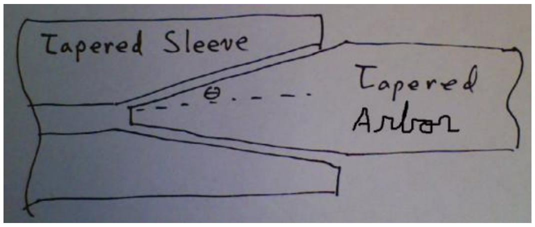


the small taper angle. First, recall the definition of the coefficient of static friction. When we push on a block of weight W that rests on a flat surface, it will remain stationary until a large enough force F just begins to move it (see sketch at left). The numerical ratio F/W is called the coefficient of static friction and depends mostly on the material and roughness of the block and surface. Neither the weight of the block nor the amount of contact surface area will appreciably affect the numerical value of F/W.

Now, an alternative way to determine the coefficient of static friction is to incline the surface and note the angle ϴ where the block just starts sliding down the hill (see drawing at right). At this incline, F = W sin(ϴ) and S = W cos(ϴ). The Ratio F/S = tan(ϴ). Hence, F/S, which is defined as the coefficient of friction, is just equal to the trigonometric tangent of the incline angle.



Now, consider a tapered sleeve fitted over a similar tapered arbor. The half angle or incline of the taper is again denoted by the angle ϴ (see drawing below). As long as the tangent of the half taper angle is less than the coefficient of friction between the sleeve and the arbor, it will provide a self-holding taper. When the half taper angle is greater than the coefficient of friction, the socket will drop out from the socket by its own accord, no matter how hard they were pressed together.



So, what is the value of the half taper angle that separates self-holding from fast tapers? The coefficient of friction for steel-on-steel is between 0.15 and 0.6. It’s toward the smaller value for ground hardened steel, and so, a half taper angle of about 8.5 degrees separates self-holding from fast tapers. The tangent of the half angle of the self-holding Morse taper is 0.025, corresponding to an angle of 1.4 degrees. The fast NMTB half angle taper tangent is 0.3, corresponding to an angle of about 16.7 degrees.

Sometimes a fast taper gets stuck and may require a tap on the draw bar to release an arbor or collet. This can happen on highly polished and oiled spindles and collets, and often results more from surface tension and atmospheric pressure rather than the frictional property of a “self holding” taper. The tapered R8 collet has a half taper angle of 8.5 degrees, right on the border of being either “self-holding” or “fast”.

Painting the Monarch 10EE Lathe

By *Martin Kennedy*

I recently purchased a 1943 vintage Monarch 10EE lathe. It ran, but needed some electrical and mechanical work to get it back to original condition. Additionally, the paint job was in terrible condition. It had been repainted only once in 70 years, and that had evidentially been many years back.

Lathe on day of purchase

The first step in painting the lathe was cleaning it. This was a much bigger job than I originally thought. Every surface of the lathe was covered with oil and grease to the point that just brushing up against the lathe left me covered in oil. There was swarf in every nook and cranny, including quite a bit inside what should have been sealed compartments in the lathe base. I spoke to someone that had owned the lathe about 10 years earlier, and he said that when he got it, it had been in storage for a long time, and he had spent many days cleaning it. It must have been really bad!

For the cleaning, I started by removing all the loose swarf and gunk. I scraped especially heavy deposits with a putty knife. I then sprayed three cans of Gunk Engine Brite Engine Degreaser on the outside of the lathe and on the inside of the base. I let it sit for about an hour.

Cleaning was made more difficult because the lathe is too heavy to move very much. All of the cleaning was done inside my garage. This was problematic because the next step was to water blast the lathe. I hung plastic tarps from the track for the garage door to somewhat protect the inside of the garage. I put on some old clothes, and had at it with the water blaster. It was a good thing that I hung the tarps, because most of what I did with the water blaster moved the oil and grease from the lathe to me and to the tarps!

The Gunk Engine Degreaser got a lot of the oil, but it left a thin oily film. To remove this, I used Clean-Rite Purple Power Cleaner/Degreaser and lots of paper towels. This degreaser works well, and is sold under a variety of names. All contain Sodium Hydroxide, Sodium Metasilicate and 2-butoxyethanol. You should have good ventilation when using cleaners containing 2-butoxyethanol. It's a good idea to read the MSDS.

I read a lot about painting lathes on the internet. On one end of the scale, people (mostly resellers) did a rudimentary cleaning job and painted over the old paint on the outside of the lathe without any disassembly. On the other end, people stripped the equipment to bare metal. They completely disassembled the lathe. Since these lathes are made of cast iron, which has a somewhat rough finish, they then filled in all the irregularities on the outside of the lathe with various types of bondo and sanded to an automobile-quality smoothness. They then painted the outside and inside of the lathe.

I decided to do something in between. I sanded the entire outside of the lathe. I used 100 and 150 grit sandpaper. I used a palm sander for the flat surfaces, and sanded the remainder by hand. I didn't take the paint to bare metal, except where it already was bare. I tried to sand to make it as smooth as possible where the paint had chipped. I didn't use any type of filler. The only thing that I did fill was some old tapped holes that had been added and were not necessary for my use. I used JB Weld KwikSteel, which I find very good for filling drill holes. I did remove the carriage and all parts that could be unbolted or removed. This sanding took several days.

Note that older equipment may have been painted with lead-based fillers. I didn't sand the filler coat off the machine where it was present. I did use a respirator when I was sanding.

Next, I set up a "paint booth" by hanging plastic in the garage again. I wiped down the lathe with Mineral Spirits. I ended up pulling the gearbox because it was weeping oil at the seams. The Monarch has several places where there are passages that drain into the sump, and I cleaned out all of these. I removed most cap screws and bolts, since I didn't want to paint the heads.

I drained oil from all five of the reservoirs. I taped up everywhere I didn't want to paint. I plugged all of the holes where parts had been removed. I made aluminum plugs to fill some of the openings. I cleaned out all of the drain passages and plugged them with paper towels. I was ready to paint.

I read up on several types of paint. The consensus seemed to be that you should use epoxy. Some epoxies are two part, with a hardener. There are water-based and oil-based epoxies. Some of the two part epoxies require forced air breathing systems because they use isocyanate in the hardner, and have VERY toxic fumes. These paints are not really appropriate for home shop use. Again, carefully read the MSDS.

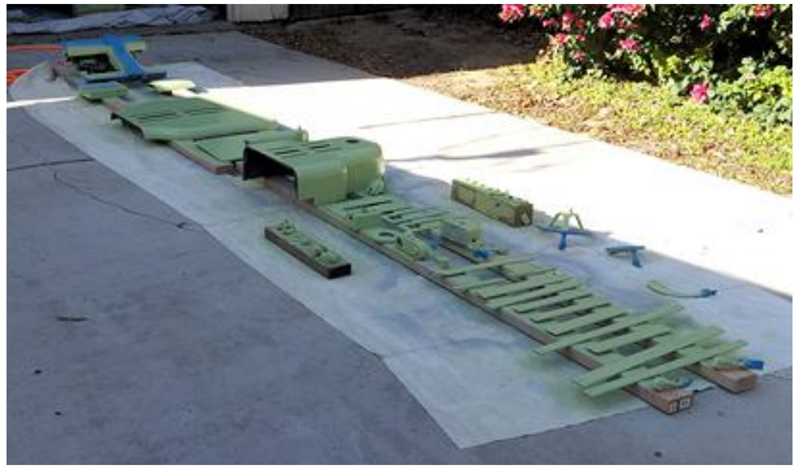
I ended up using an oil-based one part enamel. I found that the downside of this type of paint is that it takes a really long time to get really hard. It dries to the touch in a day, but after more than a month, it's still not completely dry. If I had it to do again, I would be tempted to use one of the two-part epoxies. One disadvantage of this is that I had three sessions of touch-up painting after I finished painting, and that's easier when you don't have to mix up the paint.

I considered using a primer coat. I got different advice on this, but ultimately decided to prime, since I had several spots with bare metal. The paint I used was from Benjamin Moore. The primer was Super Spec HP Universal Alkyd Metal Primer, and the top coat was Super Spec HP Urethane Alkyd Gloss Enamel. I bought a gallon of each and ended up using about ½ gallon of the primer and 2/3 gallon of the top coat. The paint costs about $50/gallon.

The lathe was originally painted with a dark grey primer coat and a lighter grey top coat. I've worked my whole life around grey equipment, and I wanted some other color. I considered dark and light blue, dark and light green, and red. I settled on a light green, as I like the color and I think it goes well with the rounded Art Deco design of the lathe. The specific shade I used was Woodland Hills Green #543.

The paint gun I used was an inexpensive Central Pneumatic HVLP gravity feed spray gun from Harbor Freight. It worked well. I put on two coats of primer. It dries quickly, so I didn't have problems with it wanting to run. I lightly sanded between coats. I then put on two top coats. The paint is fairly thick, so although it will run if you stay on one spot, it's fairly easy to keep this from happening

Lathe after taping and one coat of prime



All the miscellaneous parts after one top coat

Completed paint job

Many of the parts that I left unpainted required more cleaning than just wiping them down. The dozen or so knobs used on the doors are made, I believe, of cast zinc. They were very dull and had a layer of corrosion. I spun them in another lathe and used a Scotch Brite hand pad to shine them up. Many of the other parts were cleaned with the Scotch Brite hand pads. I cleaned up the screw heads on a Scotch Brite wheel. I sanded the nameplates on a very flat surface with some 600 grit sandpaper to bring out the text. I read that these parts will quickly become grey again, and some people have chrome plated the plates.

I think that the lathe paint job came out well! It's almost too pretty to use. Almost. Even though it's not automotive-smooth, the relatively thick top coats covered up a lot of sins. After a month, the paint is much harder. I think that it'll dry to a very hard finish, but it may take a few more months and some hot, dry weather.

Here are some detail photos of the lathe. That's a DRO assembly hanging off the back.